

What is claimed is:

1. A medical image processing system comprising an image processing section for performing image processing including at least gradation processing on a medical image, a display formatting section for transforming the medical image processed in order to generate an image to be displayed, and an image output section for outputting the image to be displayed to an image recording device,

wherein the image processing section generates, based on at least one medical image obtained by radiographing a subject, a plurality of processed images composed of at least one main image and at least one sub image generated by reducing the whole of the at least one medical image, and

the display formatting section generates one image to be displayed by synthesizing the main image and the sub image.

2. The system of claim 1, further comprising a diagnosis aid information generating section for generating diagnosis aid information by analyzing the medical image,

wherein the display formatting section adds annotation corresponding to the diagnosis aid information generated by the diagnosis aid information generating section to the at least one sub image.

3. The system of claim 1, wherein the image processing section determines an image processing condition for the main

image and an image processing condition for the sub image respectively by analyzing the medical image, and generates the plurality of processed images composed of the at least one main image and the at least one sub image by using the image processing conditions determined.

4. The system of claim 3, wherein the image processing condition includes a gradation processing condition, and the image processing section determines the gradation processing condition so as to make an average gradient of the sub image smaller than an average gradient of the main image.

5. The system of claim 3, wherein the image processing condition includes a gradation processing condition, and the image processing section determines the gradation processing condition so as to make an average gradient of the sub image have an opposite sign value to a value of an average gradient of the main image.

6. The system of claim 3, wherein the image processing condition includes a frequency processing condition, and the image processing section determines the frequency processing condition so as to make low frequency components of the sub image have smaller amount than low frequency components of the main image.

7. The system of claim 1, further comprising an image recording device information storage section for storing image recording device information corresponding to the image recording device,

wherein the image processing section determines an image processing condition based on an analysis result of the medical image and the image recording device information.

8. The system of claim 1, wherein the image processing section comprises a schema image generating section for automatically generating a schema by analyzing the medical image, and for generating the at least one sub image including the schema.

9. The system of claim 1, further comprising a sub image display assigning information input section for externally inputting information in order to assign whether the sub image is to be displayed or not,

wherein the display formatting section generates the image to be displayed with the sub image displayed or an image to be displayed without the sub image displayed on the basis of the sub image display assigning information inputted externally.

10. The system of claim 2, wherein the diagnosis aid information generating section detects an abnormal shadow

candidate in the medical image, and generates the diagnosis aid information including location information in regard to the abnormal shadow candidate detected in the medical image.

11. The system of claim 2, wherein the diagnosis aid information generating section performs image measurement on the medical image, and generates the diagnosis aid information including location information in regard to a result of the image measurement in the medical image.

12. The system of claim 1, wherein the image output section comprises:

a plurality of output channels corresponding to a plurality of image recording devices;

an output channel selecting section for selecting any one among the plurality of output channels to which an image is outputted; and

an image recording device information storage section for storing image recording device information of the image recording device set per each of the output channels,

the display formatting section generates the image to be displayed on the basis of the image recording device information which corresponds to the output channel selected by the output channel selecting section; and which is stored in the image recording device information storage section.

13. The system of claim 1, further comprising:

an image display section for displaying on a monitor, the image to be displayed generated by the display formatting section;

an image to be displayed modifying information input section for externally inputting modifying information for modifying the image to be displayed; and

a display image modifying section for modifying the image to be displayed on the basis of the image to be displayed modifying information inputted externally.

14. The system of claim 2, further comprising a diagnosis aid information storage section for storing the diagnosis aid information as related to image data of the medical image,

wherein the display formatting section loads the diagnosis aid information stored in the diagnosis aid information storage section, and generates the image to be displayed on the basis of the diagnosis aid information.

15. The system of claim 1, further comprising an image processing condition storage section for storing an image processing condition of image processing as related to image data of the medical image, the image processing performed on the medical image by the image processing section,

wherein the image processing section loads the image

processing condition stored in the image processing condition storage section, and generates the plurality of processed images on the basis of the image processing condition.

16. The system of claim 1, further comprising a display format storage section for storing an image to be displayed generating condition applied on the medical image by the display formatting section, or image data of the image to be displayed generated by the display formatting section, as related to image data of the medical image,

wherein the display formatting section loads at least one of the image to be displayed generating condition stored in the display format storage section and data of the image to be displayed in order to generate the image to be displayed.

17. The system of claim 8, further comprising a schema image storage section for storing image data of the schema as related to image data of the medical image,

wherein the display formatting section loads the image data of the schema stored in the schema image storage section in order to generate the image to be displayed on the basis of the image data of the schema.

18. The system of claim 1, wherein the display formatting section comprises:

an image size adjusting section for performing size

adjustment on each of the main image and the sub image; and  
an image synthesizing section for synthesizing the  
main image size-adjusted and the sub image size-adjusted.

19. The system of claim 18, wherein the image size  
adjusting section performs the size adjustment so as to make  
an image size of the sub image smaller than an image size of  
the main image.

20. The system of claim 19, wherein the image  
synthesizing section synthesizes the sub image size-adjusted  
with the main image size-adjusted so as to fit the sub image  
into predetermined area in the main image.

21. The system of claim 20, wherein the image  
synthesizing section determines a location for fitting the  
sub image size-adjusted on the basis of image attribute  
information of the medical image.

22. The system of claim 20, wherein the display  
formatting section comprises a subject area recognizing  
section for recognizing subject area by analyzing the medical  
image, and

the image synthesizing section determines a location  
into which the sub image size-adjusted is to be fitted on the  
basis of information of the subject area recognized.

23. The system of claim 22, wherein the image size adjusting section adjusts the image size of the sub image on the basis of the information of the subject area recognized.

24. The system of claim 1, wherein the diagnosis aid information generating section generates a plurality of pieces of diagnosis aid information different from one another based on the same medical image, and

the image processing section generates the at least one sub image per each of the plurality of pieces of diagnosis aid information.

25. The system of claim 1, further comprising:  
a modality for generating the medical image by radiographing the subject; and  
an abnormal shadow candidate detecting section for analyzing the medical image generated in order to detect an abnormal shadow candidate,

wherein the image processing section comprises a reduced medical image generating section for reducing at a predetermined magnifying rate, the whole of the medical image, in order to generate a reduced medical image as the sub image, and

the display formatting section comprises:

a reduced abnormality displayed image generating

section for overlapping a result of the detection of the abnormal shadow candidate on the reduced medical image generated in order to generate a reduced abnormality displayed image as the sub image; and

a synthesized image generating section for recognizing subject area of the main image generated, and for locating at least one of the reduced medical image and the reduced abnormality displayed image with information of the subject area recognized in the main image maintained in order to synthesize the main image with at least one of the reduced medical image and the reduced abnormality displayed image as the sub image into a synthesized image.

26. The system of claim 25, further comprising:

an obtaining section for obtaining at least one of an other modality image of the same radiographic part of the same subject, generated by a modality other than the modality that has generated the medical image, and a past medical image generated by the same modality; and

an obtained image storage section for storing at least one of the other modality image obtained and the past medical image obtained,

wherein the image processing section comprises an obtained image processing section for loading at least one of the other modality image and the past medical image from the obtained image storage section, and for reducing at the

predetermined magnifying rate, the image loaded in order to generate the reduced medical image as the sub image, and

at least one of the reduced medical image and the reduced abnormality displayed image to be synthesized with the main image by the synthesized image generating section is any one of the images indicated by the following items (1) to (5),

(1) a reduced medical image of the same medical image as the main image;

(2) a reduced abnormality displayed image of the same medical image as the main image;

(3) a reduced medical image of another medical image related to the medical image of the main image;

(4) a reduced abnormality displayed image of another medical image related to the medical image of the main image; and

(5) a reduced medical image obtained from the obtained image processing section.

27. The system of claim 26, wherein the obtained image processing section performs at least one among gradation processing, frequency processing and processing for adding information indicating a modality type in an image, on the reduced other modality image.

28. The system of claim 25, wherein the reduced abnormality displayed image generating section overlaps at

least annotation information as the result of the detection of the abnormal shadow candidate in order to generate the reduced abnormality displayed image on the reduced medical image generated by the reduced medical image generating section, the annotation information indicating a location of the abnormal shadow candidate.

29. The system of claim 25, wherein the reduced medical image generating section further recognizes the subject area by analyzing the reduced medical image, and performs density correction so as to make area other than the subject area recognized have more than predetermined density.

30. The system of claim 26, wherein the obtained image processing section further analyzes at least one of the other modality image reduced and the past medical image reduced in order to recognize each subject area, and performs density correction so as to make area other than the each subject area recognized have more than predetermined density.

31. The system of claim 25, further comprising a size information adding section for adding at least one of scale calibration and information indicating a reduction ratio on at least one of the reduced medical image and the reduced abnormality displayed image generated by the reduced medical image generating section.

32. The system of claim 26, further comprising a size information adding section for adding at least one of scale calibration and information indicating a reduction ratio on at least one of the reduced medical image and the reduced abnormality displayed image generated by the obtained image processing section.

33. The system of claim 25, further comprising:  
a findings information input section for inputting findings information corresponding to the image to be displayed; and  
a findings information adding section for adding the findings information inputted to the image to be displayed to be outputted by the image output section.

34. The system of claim 33, further comprising a findings information storage section for storing information inputted from the findings information input section as related to the medical image to be set as the main image.

35. The system of claim 25, wherein, when the main image is mammography, the synthesized image generating section locates at least one of the reduced medical image as the sub image and the reduced abnormality displayed image as the sub image in the main image in order to synthesize the

images in any one of the following forms indicated by items

(1) to (8) :

(1) main images (MLO(oblique direction)-R(right breast), L(left breast)) and reduced medical images (CC(vertical direction)-R, L) ;

(2) main images (CC-R, L) and reduced medical images (MLO-R, L) ;

(3) main images (MLO-R, CC-R) and reduced medical images (MLO-L, CC-L) ;

(4) main images (MLO-L, CC-L) and reduced medical images (MLO-R, CC-R) ;

(5) main images (MLO-R, L) and reduced abnormality displayed images (CC-R, L) ;

(6) main images (CC-R, L) and reduced abnormality displayed images (MLO-R, L) ;

(7) main images (MLO-R, CC-R) and reduced abnormality displayed images (MLO-L, CC-L) ; and

(8) main images (MLO-L, CC-L) and reduced abnormality displayed images (MLO-R, CC-R) .

36. The system of claim 25, wherein, when the main image is mammography, the synthesized image generating section locates at least one of the reduced medical image and the reduced abnormality displayed image in the main image in order to synthesize the images in any one of following forms

(1) to (8) :

- (1) a main image (MLO-R) and reduced medical images (MLO-R, CC-R);
- (2) a main image (MLO-L) and reduced medical images (MLO-L, CC-L);
- (3) a main image (CC-R) and reduced medical images (MLO-R, CC-R);
- (4) a main image (CC-L) and reduced medical images (MLO-L, CC-L);
- (5) a main image (MLO-R) and reduced abnormality displayed images (MLO-R, CC-R);
- (6) a main image (MLO-L) and reduced abnormality displayed images (MLO-L, CC-L);
- (7) a main image (CC-R) and reduced abnormality displayed images (MLO-R, CC-R); and
- (8) a main image (CC-L) and reduced abnormality displayed images (MLO-L, CC-L).

37. The system of claim 25, wherein the synthesized image generating section recognizes the subject area of the main image, and performs size adjustment on at least one of the reduced medical image and the reduced abnormality displayed image to be synthesized with the main image, according to a ratio between the subject area and area other than the subject area in the main image.

38. The system of claim 25, wherein, when at least

one of a plurality of the reduced medical images and a plurality of the reduced abnormality displayed images are synthesized with the main image, the synthesized image generating section performs size adjustment on each of the images to be synthesized with the main image so as to make the image to be synthesized have the same size.

39. The system of claim 25, wherein, when the main image is composed of two images at a left side and a right side, the synthesized image generating section recognizes subject area of each of the two images, and performs synthesis so as to make relative location relation between each subject area recognized and at least one of the reduced medical image and the reduced abnormality displayed image in the main image have the same appearance or symmetric appearance at the left side and the right side.

40. The system of claim 25, further comprising a selecting section for selecting a medical image to be set as the main image and a medical image to be set as the sub image among a plurality of medical images generated in the same examination by the modality under different radiographing conditions.

41. The system of claim 25, further comprising an assigning section for assigning whether the reduced medical

image is set as the sub image or the reduced abnormality displayed image is set as the sub image.

42. The system of claim 25, further comprising:  
at least one modality, and  
a managing device for storing and managing medical images generated by the at least one modality as related to accompanying information thereof,

wherein the image processing device comprises a selecting section for selecting a medical image to be set as the main image and a medical image to be set as the sub image among at least one of the medical images generated by the at least one modality and the medical images stored in the managing device.

43. The system of claim 42, wherein, after the selecting section selects the medical image to be set as the main image, the selecting section extracts medical images related to the main image from at least one of the medical images generated by the at least one modality and the medical images stored in the managing device on the basis of the accompanying information, displays a list of the medical images extracted on a display screen as sub image candidates, and selects a medical image to be set as the sub image among the sub image candidates displayed.

44. The system of claim 42, wherein the selecting section is capable of selecting a plurality of sub images corresponding to the main image.

45. A method for processing a medical image, comprising:

generating a plurality of processed images composed of at least one main image and at least one sub image generated by reducing the whole of a medical image on the basis of at least one medical image generated by radiographing a subject;

generating one image to be displayed by synthesizing the main image and the sub image; and

outputting the image to be displayed to an image recording device.